CLAIMS

What is claimed is:

1. A dual chamber fuel cell element, comprising:

a dual chamber fuel cell stack layer comprising anode, cathode and electrolyte materials deposited on one side of a substrate.

2. The element of claim 1 wherein one or more separated flow passageways are formed between the stack and the substrate.

3. The element of claim 1 wherein the stack comprises a thickness of equal to or less than 50 μm.

4. The element of claim 1 wherein the stack comprises a thickness of equal to or less than 20 μm.

5. The element of claim 1 wherein the stack comprises a thickness of equal to or less than 1 μm.

6. The element of claim 1 further comprising current collectors.

7. A dual chamber fuel cell element having a supported fuel cell stack comprising integrated flow passageways between the fuel cell stack and the support.

8. The element of claim 7 wherein the stack is comprised of an anode layer, an electrolyte layer and a cathode layer.

9. The element of claim 7 wherein the stack comprises a thickness of equal to or less than 50 μm.

10. The element of claim 7 wherein the stack comprises a thickness of equal to or less than 20 μm.

11. The element of claim 7 wherein the stack comprises a thickness of equal to or less than 1 μm.

12. A dual chamber fuel cell element, comprising:
a fuel cell stack supported on one side of a substrate; and
a means for passing a separated fuel stream and an oxygen containing stream over the fuel cell stack on the same side of the substrate;
wherein the fuel stream and oxygen containing stream remain separated when exposed to the stack.

13. The element of claim 12 wherein the stack comprises a thickness of equal to or less than 50 μm.

14. The element of claim 12 wherein the stack comprises a thickness of equal to or less than 20 μm.

15. The element of claim 12 wherein the stack comprises a thickness of equal to or less than 1 μm.

16. A fuel cell element, comprising:
a fuel cell stack supported on a substrate, the stack comprising successive layers of anode material, electrolyte material and cathode material;
wherein the stack comprises a thickness of equal to or less than 50 μm.

17. The element of claim 16 wherein the stack is deposited on a single side of the substrate.

18. The element of claim 16 further comprising one or more integrated flow passageways between the stack and the substrate.

19. The element of claim 16 wherein the stack comprises a thickness of equal to or less than 20 μm.

20. The element of claim 16 wherein the stack comprises a thickness of equal to or less than 1 μm.

21. A fuel cell, comprising:
one or more fuel cell elements; and
a fuel cell housing;
wherein the fuel cell elements comprise a supported dual chamber fuel cell stack having integrated flow passageways between the fuel cell stack and the support.

22. The fuel cell of claim 21 wherein the stack comprises a thickness of equal to or less than 50 μm.

23. The fuel cell of claim 21 wherein the stack comprises a thickness of equal to or less than 20 μm.

24. The fuel cell of claim 21 wherein the stack comprises a thickness of equal to or less than 1 μm.

25. The fuel cell of claim 21 wherein the fuel cell elements are aligned within the fuel cell housing to allow the flow of a first gas stream within the flow passageways and a second gas stream over the fuel cell stack.

26. The fuel cell of claim 25 wherein the first gas stream comprises a fuel.

27. The fuel cell of claim 25 wherein the second gas stream comprises an oxygen containing gas.

28. The fuel cell of claim 25 wherein the first gas stream comprises an oxygen containing gas.

29. The fuel cell of claim 25 wherein the second gas stream comprises a fuel.

30. A method for forming a dual chamber fuel cell element, comprising:

depositing a fuel cell stack onto a sacrificial material supported by a substrate;

removing the sacrificial layer to form one or more flow passageways between the fuel cell stack and substrate.

31. The method of claim 30 wherein the sacrificial material comprises a material selected from the group consisting of aluminum, aluminum alloys, titanium, titanium alloys, silicon, silicon alloys, di-electric compounds, polymers, photoresist, PMMA, epoxies and silicon dioxide.

32. The method of claim 30 wherein the sacrificial material is removed using a wet etching technique.

33. The method of claim 32 wherein the etching material comprises a material selected from the group consisting of TMAH, acetone, acids and bases.

34. The method of claim 30 wherein the sacrificial material is removed using a dry etching technique.

35. The method of claim 30 wherein the stack is comprised of successive layers of anode, electrolyte and cathode materials.

36. A method for manufacturing a dual chamber fuel cell element, comprising:

(a) depositing a current collector material on a substrate;

(b) patterning a sacrificial material on the current collector material ;

(c) depositing a fuel cell stack over the exposed current collector material and sacrificial material;

(d) patterning additional current collector material on at least a portion of the fuel cell stack;

(e) exposing the sacrificial material; and

(f) removing the sacrificial material.

37. A method preparing a fuel cell element, comprising:
depositing anode material, electrolyte material and cathode material on a support to form a fuel cell stack; and
a step for creating flow passageways between the stack and support.

38. The method of claim 37 wherein the flow passageways are above the surface of the support.

39. The method of claim 37 wherein the flow passageways are along the surface of the support.